REMARKS

The Examiner is thanked for the thorough examination of the present application. The Office Action, however, tentatively rejected claims 1-6, 8, 9, 11-14, and 16-29. In response, Applicants submit the foregoing amendments and the following comments. Claims 1, 12, 20 are amended, and claims 2-3, 13-14, and 21-22 are canceled. Applicants respectfully request reconsideration and withdrawal of the rejections for at least the following reasons.

I. Response to Claim Rejections Under 35 U.S.C. § 102

It is axiomatic that "[a]nticipation requires the disclosure in a single prior art reference of each element of the claim under consideration." *W. L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1554, 220 USPQ 303, 313 (Fed. Cir. 1983). Therefore, every claimed feature of the claimed invention must be represented in the applied reference to constitute a proper rejection under 35 U.S.C. § 102.

Claim 6 stands rejected under 35 U.S.C. §102 as allegedly being anticipated by *Masato et al.* (JP Publication No. 2001-053712, hereinafter "*Masato*"). For at least the reasons set forth below, Applicants traverse these rejections.

A. Claims 6 and 8

Applicants respectfully submit that independent claim 6 patently defines over *Masato* for at least the reason that *Masato* fails to disclose, teach, or suggest the features emphasized below in claim 6.

Claim 6 recites:

> 6. An apparatus for phase compensation at a receiver of a communication system, wherein a symbol signal modulated by a carrier is transmitted via a plurality of subchannels, wherein the symbol signal comprises a pilot signal and the subchannels

> comprise at least a pilot subchannel for transmitting the pilot signal, the apparatus comprising:
>
> a carrier frequency offset compensator to perform a carrier frequency offset compensation on the symbol signal;
>
> a channel compensator to perform a channel compensation on the symbol signal;
>
> a phase error estimator for extracting the pilot signal and generating an estimated residual phase error between the extracted pilot signal and an original pilot signal;
>
> a buffer for storing the estimated residual phase error; and
>
> a phase rotator, coupled to the buffer, for compensating a following symbol signal according to the estimated residual phase error;
>
> ***wherein the following symbol signal is compensated by the channel compensator after being compensated by the phase rotator***.

(Emphasis Added). For the feature emphasized above, the Office Action refers to the *Masato* reference and specifically cites Drawing 3 (elements 207-209), Drawing 4 (elements 3011-3015), and paragraphs 22, 27. (Office Action, pages 3-4). The Office Action then asserts that these figures and passages in *Masato* are interpreted as disclosing "*performing weighting using the channel transfer function for every subcarrier determined in the channel equalizing circuit*." (Office Action, page 4). Applicants respectfully submit that it is unclear how this reads on the feature "wherein the data signal is compensated by a data subchannel compensator ***after*** being compensated by the phase rotator." As defined in claim 6 above, the phase rotator compensates a following symbol signal according to the estimated residual phase error.

With reference to Drawing 3, element 207 is a pilot subcarrier extract circuit, 208 is a phase rotation detector, and 209 is a phase compensator. With reference to Drawing 4 of *Masato*, element 3011 relates to a pilot subcarrier extract circuit, 3012 is a phase rotation detector, 3013 is a phase rotation average circuit, 3014 is a filter, and 3015 is a phase compensator. In fact, elements 3011-3015 in Drawing 4 appear to be

directed to amending the phase rotation by the phase noise (see *Masato*, English translation, paragraph [0027]: " . . . phase rotation by the phase noise is amended succeedingly."). Drawings 3 and 4 are both directed to the operation of the phase tracking circuit for multi-carriers. See paragraphs [0019], [0024]. Applicants respectfully submit that the operation of the elements above do not read on the feature emphasized above. Paragraphs [0022] and [0027], in fact, begin by stating "**Next**, phase rotation by the phase noise is amended . . ." If anything, this appears to be inconsistent with the order expressly defined in the claim language "wherein the data signal is compensated by a data subchannel compensator after being compensated by the phase rotator." Applicants note that paragraphs [0022] and [0027] do not appear to further disclose compensation perform by a data subchannel compensator after phase rotation. Furthermore, *Hamaguchi* does not address this deficiency. In this regard, the cited references fail to disclose or suggest the feature emphasized above in claim 9. While the Examiner may counter by reasoning that this is a matter of obvious design choice, Applicants submits that without support, this would be conclusory in nature. In fact, the specification describes alternative embodiments whereby the order is modified:

> [0062] The architecture of FIG. 7a can be modified as FIG. 7b, where the components of the apparatus 70b are the same as those of the apparatus 70a, while in operation, the architecture of FIG. 7b compensates the data signal of the received OFDM symbol by a data subchannel compensator 75 ***before*** providing it to the phase rotator 74.

(Emphasis added). In view of the foregoing, Applicants respectfully submit that independent claim 6 patently defines over *Masato* for at least the reason that *Masato* fails to disclose, teach, or suggest the highlighted features in claim 6 above. Applicants submit that dependent claim 8 is allowable for at least the reason that this

claim depends from an allowable independent claim. *See, e.g., In re Fine*, 837 F. 2d 1071 (Fed. Cir. 1988).

Note: While the Office Action indicates that claim 8 is pending, the Office Action does not appear to specifically address claim 8. Applicants respectfully request clarification from the Examiner on whether claim 8 contains allowable subject matter should an ensuing Office Action be issued.

II. Response to Claim Rejections Under 35 U.S.C. § 103

For a proper rejection of the claim under 35 U.S.C. §103, the cited combination of references must disclose, teach, or suggest all elements / features of the claim at issue. See, e.g., *In re Dow Chemical*, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988) and *In re Keller*, 208 U.S.P.Q.2d 871, 881 (C.C.P.A. 1981).

Claims 1, 3-5, 9-13, 15-19, 20, 21, and 23-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Masato* in view of *Hamaguchi* (JP Application No. 409093302). Claims 2, 14, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Masato* in view of *Hamaguchi* in further view of *Frank et al.* (U.S. Patent No. 7,324,599, hereinafter "*Frank*"). For at least the reasons set forth below, Applicants respectfully traverse the rejections.

B. Claims 1, 4-5, 12, 15-20, and 23-24

Applicants respectfully submit that independent claim 1 patently defines over *Masato* in view of *Hamaguchi* for at least the reason that the combination fails to disclose, teach, or suggest the features emphasized below in claim 1.

Claim 1, as amended, recites:

> 1. An apparatus for carrier frequency offset compensation at a receiver of a communication system, wherein a symbol signal

> modulated by a carrier is transmitted via a plurality of subchannels, wherein the symbol signal comprises a pilot signal and the subchannels comprise at least a pilot subchannel for transmitting the pilot signal, the apparatus comprising:
>
> a pilot subchannel estimator for generating an estimated frequency response of the pilot signal;
>
> a frequency offset estimator, coupled to the pilot subchannel estimator, for ***generating an estimated carrier frequency offset according to a phase error between the estimated frequency response of the symbol signal in a frequency domain and an estimated frequency response of a following symbol signal in the frequency domain***;
>
> a phase accumulator, coupled to the frequency offset estimator, for calculating an accumulated phase rotation according to the estimated carrier frequency offset; and
>
> a phase rotator, coupled to the phase accumulator, for carrier frequency offset compensation according to the accumulated phase rotation, ***wherein based on the magnitude of the carrier frequency offset, the phase rotator performs frequency offset compensation in either the time domain or the frequency domain***.

(Emphasis added). Applicants have amended claim 1 to now recite the feature "wherein based on the magnitude of the carrier frequency offset, the phase rotator performs frequency offset compensation in either the time domain or the frequency domain." No new matter is added. Claims 2 and 3 are canceled. Support for this feature can be found, for example, in paragraphs [0037]-[0046] of the specification. Applicants submit that neither *Hamaguchi* nor *Masato* discloses or suggests this feature. While the Office Action contends on page 7 that the *Frank* reference discloses carrier frequency offset compensation in the time domain, *Frank* does not disclose or suggest that the phase rotator performs frequency offset compensation in either the time domain or the frequency domain, where this is based on the magnitude of the carrier frequency offset. As described in the specification, when the carrier frequency offset is not large, the influence of the ICI term $\Gamma_{n,k}$ (in equation 1-2) can be ignored, and the amplitude and

phase distortion can be removed by channel compensation. Thus, compensation of the accumulated phase rotation maybe performed in the frequency domain. When the carrier frequency offset is large, the ICI term $\Gamma_{n,k}$ in equation (1-2) cannot be ignored in the frequency domain. Thus, compensation of the accumulated phase rotation may be performed in the time domain. Applicants respectfully submit that the cited art of record fails to disclose or suggest the feature "wherein based on the magnitude of the carrier frequency offset, the phase rotator performs frequency offset compensation in either the time domain or the frequency domain."

Accordingly, Applicants respectfully submit that independent claim 1 patently defines over *Masato* in view of *Hamaguchi*. Furthermore, Applicants submit that dependent claims 4-5 are allowable for at least the reason that these claims depend from an allowable independent claim.

Claim 12, as amended, recites:

> 12. A compensating module at a receiver of a communication system, wherein a symbol signal modulated by a carrier is transmitted via a plurality of subchannels, wherein the symbol signal comprises at least a pilot signal and at least a data signal, and the subchannels comprise at least a pilot subchannel for transmitting the pilot signal and at least a data subchannel for transmitting the data signal, the compensating module comprising:
>
> . . .
>
> a phase rotator, coupled to the phase accumulator, for performing frequency offset compensation according to the accumulated phase rotation, ***wherein based on the magnitude of the carrier frequency offset, the phase rotator performs frequency offset compensation in either the time domain or the frequency domain***.

Claim 20, as amended recites:

> 20. A method for carrier frequency offset compensation used at a receiver of a communication system, wherein a symbol signal modulated by a carrier is transmitted via a plurality of subchannels,

> wherein the symbol signal comprises at least a pilot signal and the subchannels comprise at least a pilot subchannel for transmitting the pilot signal, the method comprising:
>
> . . .
>
> ***based on the magnitude of the carrier frequency offset, utilizing a phase rotator to perform carrier frequency offset compensation according to the accumulated phase rotation in either the time domain or the frequency domain***.

(Emphasis added). Claims 13-14 and 21-22 are canceled. On page 4, the Office Action rejects independent claims 1, 12, and 20 collectively. As the newly added feature of claim 1 has been similarly incorporated into independent claims 12 and 20, Applicants submit that these claims are patentable over *Masato* in view of *Hamaguchi* for reasons similar to those set forth above for claim 1. Dependent claims 15-19 and 23-24 are allowable for at least the reason that these claims depend from allowable independent claims.

C. Claims 9-13, 25-26, and 27-29

Applicants respectfully submit that independent claim 9 patently defines over *Masato* in view of *Hamaguchi* for at least the reason that the combination fails to disclose, teach, or suggest the features emphasized below in claim 9.

Claim 9 recites:

> 9. An apparatus for phase compensation at a receiver of a communication system, wherein a symbol signal modulated by a carrier is transmitted via a plurality of subchannels, wherein the symbol signal comprises a least a pilot signal and at least a data signal, and the subchannels comprise at least a pilot subchannel for transmitting the pilot signal and at least a data subchannel for transmitting the data signal, the apparatus comprising:
>
> a carrier frequency offset compensator to perform a carrier frequency offset compensation on the symbol signal;
>
> a buffer for storing the symbol signal after carrier frequency offset compensation;

> a pilot subchannel compensator, coupled to the buffer, for compensating the pilot signal to generate a channel-compensated pilot signal;
>
> a phase error estimator, coupled to the pilot subchannel compensator, for generating an estimated residual phase error between the channel-compensated pilot signal and an original pilot signal; and
>
> a phase rotator for compensating the data signal according to the estimated residual phase error;
>
> ***wherein the data signal is compensated by a data subchannel compensator after being compensated by the phase rotator***.

(Emphasis added). For the feature emphasized above, the Office Action refers to the primary *Masato* reference and specifically cites Drawing 3 (elements 207-209), Drawing 4 (elements 3011-3015), and paragraphs 22, 27. (The Office Action relies on the same rationale used in addressing claim 6.) The Office Action then asserts that these figures and passages in *Masato* are interpreted disclosing "*performing weighting using the channel transfer function for every subcarrier determined in the channel equalizing circuit*." (Office Action, page 5). Applicants respectfully submit that it is unclear how this reads on the feature "wherein the data signal is compensated by a data subchannel compensator ***after*** being compensated by the phase rotator." As defined in claim 6, the phase rotator compensates the data signal according to the estimated residual phase error.

As discussed earlier, element 207 in Drawing 3 is a pilot subcarrier extract circuit, 208 is a phase rotation detector, and 209 is a phase compensator. With reference to Drawing 4 of *Masato*, element 3011 relates to a pilot subcarrier extract circuit, 3012 is a phase rotation detector, 3013 is a phase rotation average circuit, 3014 is a filter, and 3015 is a phase compensator. In fact, elements 3011-3015 in Drawing 4 appear to be directed to amending the phase rotation by the phase noise (see *Masato*, English

translation, paragraph [0027]: ". . . phase rotation by the phase noise is amended succeedingly."). Drawings 3 and 4 are both directed to the operation of the phase tracking circuit for multi-carriers. See paragraphs [0019], [0024]. Applicants respectfully submit that the operation of the elements above do not read on the feature emphasized above. Paragraphs [0022] and [0027], in fact, begin by stating "**Next**, phase rotation by the phase noise is amended . . ." If anything, this appears to be inconsistent with the order expressly defined in the claim language "wherein the data signal is compensated by a data subchannel compensator after being compensated by the phase rotator." Applicants note that paragraphs [0022] and [0027] do not appear to further disclose compensation perform by a data subchannel compensator after phase rotation. Furthermore, *Hamaguchi* does not address this deficiency. In this regard, the cited references fail to disclose or suggest the feature emphasized above in claim 6. While the Examiner may counter by reasoning that this is a matter of obvious design choice, Applicants submits that without support, this would be conclusory in nature. In fact, the specification describes alternative embodiments whereby the order is modified:

> [0062] The architecture of FIG. 7a can be modified as FIG. 7b, where the components of the apparatus 70b are the same as those of the apparatus 70a, while in operation, the architecture of FIG. 7b compensates the data signal of the received OFDM symbol by a data subchannel compensator 75 ***before*** providing it to the phase rotator 74.

(Emphasis added). In view of the foregoing, Applicants respectfully request that the rejection of claim 9 be withdrawn. Furthermore, Applicants submit that dependent claims 10-13 are allowable for at least the reason that these claims depend from an allowable independent claim.

Claims 25 recites:

> 25. A method for phase compensation used at a receiver of a communication system, wherein a symbol signal modulated by a carrier is transmitted via a plurality of subchannels, wherein the symbol signal comprises at least a pilot signal and at least a data signal, and the subchannels comprise at least a pilot subchannel for transmitting the pilot signal and at least a data subchannel for transmitting the data signal, the method comprising:
>
> . . .
>
> ***utilizing a channel compensator to compensate the following symbol signal after compensating the following symbol signal according to the estimated residual phase error***.

Claim 27 recites:

> 27. A method for phase compensation used at a receiver of a communication system, wherein a symbol signal modulated by a carrier is transmitted via a plurality of subchannels, wherein the symbol signal comprises at least a pilot signal and at least a data signal, and the subchannels comprise at least a pilot subchannel for transmitting the pilot signal and at least a data subchannel for transmitting the data signal, the method comprising:
>
> . . .
>
> ***utilizing a data subchannel compensator to compensate the data signal after compensating the data signal according to the estimated residual phase error***.

(Emphasis added). As independent claims 25 and 27 recite features similar to those in claim 9, Applicants submit that reasons similar to those set forth above for claim 9 apply. Independent claims 25 and 27 are therefore believed to be patentable. Dependent claims 26 and 28-29 are allowable for at least the reason that these claims depend from allowable independent claims.

D. Claims 2, 14, and 22

Claims 2, 14, and 22 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Masato* in view of *Hamaguchi* further in view of *Frank*. Claims 2, 14, and 22 are canceled, thereby rendering the rejection of these claims moot.

CONCLUSION

Applicants respectfully submit that all pending claims are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested. If, in the opinion of the Examiner, a telephone conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

A credit card authorization is provided to cover the fee associated with the accompanying RCE application. No additional fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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